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SACS ENVIRONMENTAL ASSESSMENT OF METHIOCARB
FOR PHASE V

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Active Ingredient: List A

Methiocarb

Case # 0577
Chemical # 100501

The environmental fate and ecological risk assessments are based on about 90% of methiocarb's use on ornamental and greenhouse and the other 10% on turf and lawn.

D. Environmental Assessment

1. Environmental Fate

a. Environmental Chemistry, Fate and Transport

Based on incomplete supplemental and acceptable environmental fate data methiocarb appears to be moderately persistent and relatively immobile. Methiocarb degradation appears to be dependent on microbial-mediated (aerobic soil metabolism - $t_{1/2}$ = 17 to 111 days); anaerobic soil metabolism ($t_{1/2}$ = 64 days); and abiotic processes (photodegradation metabolism in water and on soil ($t_{1/2}$ = 88 days). This data indicates that methiocarb degrades in mineral soils and anaerobic soil environments, and should photodegrade slowly in soil and slightly-acidic aqueous environments. The major degradates were identified as methiocarb sulfoxide, methiocarb sulfoxide phenol, methiocarb phenol, and methiocarb sulfone. Supplemental field dissipation studies suggest methiocarb residues (e.g., methiocarb, methiocarb sulfone, and methiocarb sulfoxide) are moderately persistent ($t_{1/2}$ < 92 days) in surface soil (30 cm). Mmethiocarb was also detected in a single well in a New York well survey of 21000 wells.

b. Environmental Fate Risk Assessment

Methiocarb appears to be relatively immobile (K_d = 12.5) in loam textured soil, but methiocarb degradates as well as parent methiocarb were found to be mobile in "aged" soil column leaching studies. The mobility of methiocarb and its degradates could not be confirmed in field dissipation studies because of inadequate soil sampling and/or nonspecific analytical methodologies. Although compounds similar to methiocarb (e.g., aldicarb) are mobile in soil and have been found in groundwater, the weight of evidence from supplemental field dissipation data suggest that methiocarb, methiocarb sulfoxide, and methiocarb sulfone are retained in the surface soil(0-30 cm). The results a screening model PATRIOT (Pesticides Assessment Tool for Rating Investigations of Transport) performed over a range of soil textures for methiocarb reenforced the conclusion that methiocarb per se is not likely to contaminate groundwater. However, a full assessment will only be possible when the following confirmatory data is provided.

161-1 Hydrolysis
163-1 Adsorption-Desorption/Leaching
164-1 Terrestrial Field Dissipation

The additional confirmatory data will help to define the rates and routes of methiocarb dissipation under typical use conditions. The additional hydrolysis data would provide information on abiotic degradation of methiocarb in soil and aquatic environments. Although the unaged portion of the adsorption-desorption/leaching (163-1) study was previously fulfilled using a single soil type, additional batch equilibrium data on parent methiocarb would provide a more reliable mobility classification in coarse textured soils (e.g., sand and loamy sands) with low organic matter. Fine textured soil, which was used in the study, tends to decrease estimates of mobility. In addition, parent methiocarb was detected in the leachate of aged-residue soil column studies and hence may be mobile in coarse textured soils. The additional terrestrial field dissipation data are necessary with greater sampling depths and appropriate soil sampling increments to assess leaching of methiocarb below 30cm.

The Fish Accumulation (165-4) study would be waived because methiocarb and its degradates in aquatic systems would be prone to kill fish before the residues could accumulate in levels of concern in fish tissues. Due to methiocarb's aerial application and potential toxicity to nontarget organisms, if the turf and lawn uses are expanded, spray drift studies (droplet size spectrum 201-1 and drift field evaluation 202-1) will be needed to assess the potential off-target movement of this chemical under these use conditions.

2. Ecological Effects

There is enough ecotoxicological data submitted to characterize the toxicity of Methiocarb to nontarget terrestrial and aquatic organisms when used primarily on ornamentals and in greenhouses.

Available data indicate that Methiocarb is toxic to terrestrial mammals (acute oral LD_{50} range from 13 to 32 mg/kg for males and females rats respectively. Also, there is sufficient data to characterize technical methiocarb as **very highly toxic** to honey bees (LD_{50} for honey bees is 0.375 ug/bee, Atkins, 1967).

The avian toxicity of Methiocarb was evaluated from thirty-four studies. The data indicate that the technical grade (TGAI) of Methiocarb is **very highly toxic birds** on an acute oral basis. The LD_{50}'s to passerine species tested ranged as low as 2.47 mg/kg (Schafer et al., 1973), and the LD_{50} values to mallards (waterfowl) were determined to be 12.8 mg/kg (Hudson et al., 1984). The subacute dietary data using the TGAI indicate that Methiocarb is **practically non-toxic** to upland game birds, LC_{50} of > 5000 ppm for ring-necked pheasants (Hill et al., 1975) and **slightly toxic** to waterfowl with an LC_{50} of 1071 ppm for mallard ducks (Hill et al., 1975). It must be noted that because no feed consumption data were provided, it can not be determined if the low dietary toxicity is attributable to reduced feed consumption. Avian dietary studies using 50% dust suggest that this product is **moderately toxic** (mallard LC_{50} = 929 ppm, Hill et al., 1975) to **slightly toxic** (ring-necked pheasant LC_{50} = 8349 ppm, Hill et al., 1975) to avian species. Also, pen studies with 2% bait and 4% bait suggest that these formulations may produce a repellent effect in bobwhite quail (Carlisle et al., 1982) and pheasants (Martin, 1968) respectively. Avian reproduction studies indicate that no reproductive impairment is caused in mallard duck at a dietary dose level of 100 ppm TGAI Methiocarb (Lamb et al., 1982) or in bobwhite quail at a dietary dose level of 50 ppm (Lamb et al, 1982). Pen studies with 2% bait suggest that this formulation may produce a repellency effect in bobwhite quail (Carlisle et al., 1982).

The available data indicate that the TGAI of Methiocarb is **highly toxic** to coldwater (rainbow trout LC_{50} =0.436 ppm, Lamb, 1981) and warmwater (bluegill LC_{50} = 0.734 ppm, Lamb,1981) fish. The freshwater fish acute toxicity data on formulated products indicate the a 75% whole product (WP) formulation of Methiocarb is **moderately toxic** to coldwater (rainbow trout LC_{50} =1.4 ppm Lamb et al., 1973) and warmwater (bluegill LC_{50} = 1.9 ppm, Lamb et al., 1973) fish. Data from a fish early life stage study using rainbow trout suggest that methiocarb is **highly toxic** (the MATC of technical Methiocarb to this species is 50 to 100 ppb Carlisle, 1985). The data indicate that methiocarb is **very highly toxic** to freshwater aquatic invertebrates (48-hour EC_{50} for Daphnia magma was 0.019 ppm, Nelson et al., 1979); (48-hour EC_{50} for mayflies was 0.007 ppm, Marking et al., 1981). Data from an aquatic

invertebrate life cycle test further supports Methiocarb being classified as very highly toxic to aquatic invertebrates (test using Daphnia magna suggest that the MATC of technical methiocarb to this species is 0.10-0.17 ppb). Did not discuss estuarine studies for this use pattern. There is no estuarine data available on methiocarb.

3. Ecological Effects Risk Assessment

Risk to Terrestrial Organisms

The level of concern to mammalian and avian species is exceeded for all formulations of methiocarb. The acute toxicity data of methiocarb to rats indicate that a rat weighing 0.4 kg could obtain an LD_{50} (13 to 32 mg/kg for male and females rats respectively) eating less than 10 of the 1% (0.6mg a.i./granule) bait formulation granules. Less than one granule of the 2% (1-2 mg per granule) bait formulation or 1 % bait formulation could contain the LD_{50} for blackbirds (3.2 mg/kg), therefore, all of the granular uses would represent a hazard to blackbirds or other birds of similar size and sensitivity to the toxicant. After ingesting 10 to 20 granules of the 2% and 1% granule formulations respectively the mallard duck would reach the LD_{50} (12.8 mg/kg). Repellency data suggesting that medium to large sized birds may be repelled from treated granules, has not been clearly demonstrated; therefore, granular formulations could present a hazard to medium and larger birds.

Methiocarb 75% wettable powder is applied indirectly to avian food items as an insecticide. The chemical is applied as a spray. Therefore, residues are expected to be available to birds on a variety of food and forage items. For all application rates, except the lowest, residues on short grass trigger endangered species concern levels (1/10 LC_{50} for mallard duck, 107 ppm) from 1 to 3.5 times and restricted use criteria is triggered (1/5 LC_{50} for mallard duck 214 ppm) by 1.5 times on short grass at the highest application rate.

The majority of the labels for Methiocarb do not indicate a maximum amount of active ingredient to be applied per season nor time intervals between applications. Therefore, the EEB Fate Model for Accumulated Pesticide Residues for Multiple Applications was run for a number of different scenarios. The model looked at various application intervals (7, 20, 30 days) and initial concentrations based on vegetative residue data determined from an EEB nomograph developed by Hoerger and Kenega. The results indicate that at the lowest level of active ingredient applied per application to short grass would trigger the endangered species concern (1/10 LC_{50} for mallard duck, 107 ppm) by 1.5 times by the second application no matter if the interval was 7, 20, or 30 days. In addition, by the third application on short grass at either 7, 20, or 30 days the trigger for restricted use concern would be triggered (1/5 LC_{50} for mallard duck 214 ppm) by < 1.5 times.

Models for long grass residue indicate that at the 0.5 lbs a.i./A application triggers for both endangered species and restricted use triggers be exceeded by the 2nd and 3rd applications respectively, at all interval times (7, 20, and 30 days). The last set of models looked at the residue on leaves and leafy crops with the lowest amount of active ingredients per application. These results indicate that both endangered species and restricted use triggers by the 3rd and 5th application, respectively at 7 and 20 day intervals. At the 30 day interval endangered species and restricted use triggers were exceeded at the 3rd and 8th application. Special Review trigger levels were exceeded for small mammals (1 to 3 times the LD_{50}) at the two highest application rates for short grass. These models were run on the lowest amount of active ingredient per application; therefore, it is likely that the level of concern would be exceeded for endangered species and nontarget terrestrial organisms earlier for all other active ingredient application levels. In addition, the predicted EEC values exceed the NOEC levels for avian species with respect to chronic effects for short grass. Therefore, the use of methiocarb 75% wettable powder may be expected to result in hazard to exposed avian species both acutely and chronically.

Risk to Aquatic Organisms

The level of concern to for chronic fish and acute and chronic aquatic invertebrate is exceeded for all formulations of methiocarb. Refined EEC's were modeled for two methiocarb formulations, Mesurol 2% Bait and Mesurol 75% Wettable Powder for 1, 2, and 4 applications per year. One application per year with an occasional second application is the typical use pattern for methiocarb (Spagnoli 1993). The 75% Wettable Powder may be applied up to four times a year, there are no restrictions on the number of applications of the 2% bait, but 4 applications were modeled as the maximum number of uses for this formulation also. A New York turf farm was used for both formulations, as it is a reasonable surrogate for scenarios with significant turf coverage such as ornamentals and shade trees.

Results from the refined model on Methiocarb in Mesurol Bait 2% indicated that fish endangered species concern levels, 1/20 LC_{50}, were exceeded by 2 to 7 times & after 90 days the value was exceeded by 1 time, and restricted use levels, 1/10LC_{50}, were exceeded by 1 to 4 times but after 90 days was not exceeded. Aquatic invertebrates endangered species concern levels, 1/20 LC_{50}, were exceeded by 50 to 168 times from the first to the fourth application and after 90 days with just one application the 1/20 LC_{50} value was still exceeded by 27 times. In addition, restricted use concerns were exceeded by 26 to 84 times & after 90 days the value was exceeded by 13 times, and special review concerns, 1/5LC50, were exceeded by 5 to 17 times & after 90 days the value was exceeded by 3 times.

Results from the refined model on Methiocarb in Mesurol 75% Wettable Powder, indicated that fish endangered species concern levels were exceeded by 3 to 8 times & after 90 days by 2 times, and restricted use levels were exceeded 1 to 4 times but not exceeded after 90 days. Aquatic invertebrates endangered species concern level were exceed by 57 to 185 times from the first to the fourth application and after 90 days with just one application the endangered species concern level was still exceeded by 29 times. In addition, restricted use concerns were exceeded by 29 to 93 times & after 90 days $1/10LC_{50}$ value exceeded by 15 times, and special review level of concern values were exceeded by 8 to 19 times & after 90 days 3 times.

Endangered Species

Methiocarb (a molluscicide, insecticide and avian repellent) may pose a hazard to many listed birds, mammals, insects, and aquatic organisms. To date EEB has one recorded incident, wild bird kill, from the use of Methiocarb, Dec. 1983, Lima, Ohio -- waterfowl (NWHR 1980- 1990).

The use of Methiocarb exceeds triggers for endangered species, may affect, for avian, mammals, non-target insects, and freshwater organisms. These proposed uses cover the whole United States and are not restricted by boundaries, therefore to properly identify endangered species which may utilize these areas the U.S. Fish and Wildlife Service should be consulted. After identifying the endangered species inhabiting these areas a formal Section 7 consultation with the USFWS may be requested.

Precautionary Labeling

Restricted Use

Methiocarb should be labeled **Restricted Use for all uses.** The use of this chemical at listed rates can produce exposure levels exceeding restricted use criteria for birds, fish, and aquatic organisms.

Manufacturing Use

This pesticide is toxic to fish and very highly toxic to birds and mammals. Do not apply directly to water, or to areas below the mean high water mark. Drift and runoff from treated area may be hazardous to aquatic organisms in adjacent aquatic sites. Do not contaminate water when disposing of equipment washwaters and rinsates.

End Use -- Granular or Pelletized Bait for Molluscicide Use

This pesticide is toxic to fish and very highly toxic to birds and mammals. Do not apply directly to water, or to areas below the mean high water mark. Drift and runoff from treated area may be hazardous to aquatic organisms in adjacent aquatic

sites. Do not contaminate water when disposing of equipment washwaters and rinsates.

End Use -- 75% Wettable Powder

This pesticide is toxic to fish and very highly toxic to birds and mammals. Do not apply directly to water, or to areas below the mean high water mark. Drift and runoff from treated area may be hazardous to aquatic organisms in adjacent aquatic sites. Do not contaminate water when disposing of equipment washwaters and rinsates.

This product is very highly toxic to honey bees exposed to direct treatment or residues on blooming shrubs, flowers, weeds and trees. Do not apply this product or allow it to drift to blooming shrubs, flowers, weeds, or trees if bees are visiting the treatment area.

The "Environmental Hazards" section should include the following label statements:

- Manufacturing Use

Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or public waters unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of EPA.

- End Use

The same environmental hazard label statements indicated for the manufacturing use applies to indoor non-food (industrial use with effluent), aquatic non-food industrial and terrestrial non-food uses.

No labeling is prescribed at this time for indoor food and indoor non-food uses that do not produce effluent.

Conclusions

The ecological effects risk assessment for methiocarb indicates that for all the formulations, the acute and chronic levels of concern are exceeded for avian species, the acute level of concern is exceeded for mammalian species and aquatic invertebrates. The toxicity data used in the risk assessment suggests that the chronic level of concern is exceeded for aquatic organisms.

Some of the factors considered in further evaluation of the risk of methiocarb to nontarget organisms include, 1) refined aquatic EEC's using typical application rates, 2) methiocarb production volume, and 3) the estimate of the amount of methiocarb used for the use sites. From these considerations label

amendments, production caps, use site deletions and confirmatory data requirements are recommended.

When the aquatic EEC's were refined using maximum as well as typical application rates the level of concern was still exceeded; however, the typical use rate decreased the risk by about a factor of two. **The labels for methiocarb should reflect the typical application rate as the maximum application rate.** (2 lbs 75% wettable powder per 50 gallons of water applied up to 2, not 4, times a year, bait formulations should not be applied more that twice a year.

The volume of methiocarb used on a yearly basis in the United States was used in the evaluation of the risk assessment. Although the use of methiocarb is relatively low, approximately the same amount of Aldicarb, which is similar to methiocarb, was used in Long Island New York were Aldicarb was detected in the groundwater. Because of this fact, and the incomplete environmental fate data base for methiocarb, we can not assume that the current volume of methiocarb used does not pose a significant risk. However, **the Agency is placing a production cap on methiocarb so that the environmental risk of methiocarb use will not increase.**

The environmental fate and ecological risk assessments are based on the fact that approximately 90% of methiocarb is used in nursery and greenhouses and the other 10% of methiocarb use include homeowner ornamentals, turf and lawn sites. **To further decrease the potential risk to the environment from the use of this toxic chemical would be to only keep the 90% nursery and greenhouse uses. The Agency needs to know, on a confirmatory basis, about how much of the nursery and greenhouse use of methiocarb is in an inclosed structure.** 10% on turf and lawn.

If the lawn and turf use of methiocarb continues to be supported, the following studies are required on a confirmatory basis:

72-3 (a) Acute LC_{50} Estuarine/Marine Tox Fish

72-3 (b) Acute LC_{50} Estuarine/Marine Tox Mollusk

72-3 (c) Acute LC_{50} Estuarine/Marine Tox Shrimp

72-4 (b) Aquatic Invertebrate Life-Cycle.
(Study was submitted, however it was deemed supplemental because raw data was not available - see Rieder review 11/5/90)

72-4 (a) Fish Early Life Stage
(This study partially fulfills the requirement because of technical problem in the control tank occurred. Data describing water temperatures in each test tank are required to

ensure that no significant variance of temperature occurred in any of these tanks. If this data is submitted the study may be

72-5	Fish Life-Cycle
201-1	Droplet Size Spectrum
202-1	Drift Field Evaluation

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